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# **TAKING THE CLASSICAL LARGE AUDIENCE LECTURE ONLINE USING TABLET COMPUTER AND WEB CONFERENCING FACILITIES**

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## **ABSTRACT**

During four offerings (September 2008 – May 2011) of the course 02402 Introduction to Statistics for Engineering students at DTU, with an average of 256 students, the lecturing was carried out 100% through a tablet computer combined with the web conferencing facility Adobe Connect (version 7). This enables some extended possibilities as compared to the standard large audience university lecture:

1. Recording and subsequent online sharing of the entire lecture activity
2. Simultaneous (synchronous) viewing of the lecture on different locations (including smart phone based viewing)
3. Active student participation through chats and polls.

In this paper it will be described exactly how this can be done using audio and video equipment. The experience from different technical solutions will be described. A quantitative and qualitative analysis of the course evaluations are given that documents that students reacted positive to the initiative. The one year hit statistics of almost 10.000 during 2010 on the resulting output lecture videos indicates that the approach has a clear impact.

## **KEYWORDS**

Technology-enhanced learning, web conferencing, video recording, tablet computer, large audience lecturing, teaching statistics.

## **BACKGROUND AND METHODS**

The direct occasion for initiating this approach to the lecturing in the course 02402 was a sudden increase in the number of students signed up for the course in August 2008: At course start the number was more than 380 students. It was decided to simultaneously transmit the lecture in one (large) lecture hall to a neighbouring lecture hall. At that point in time the recording option of the Adobe Connect meeting room facility was just an added premium and the interactivity potentials of the meeting room was not used nor explored. A digital camcorder was operated by an assistant during the lecture. The video was primarily used to show/provide a small video pod of the lecturer in the corner of the meeting room screen transmitted and recorded, cf. Figure 1. The audio was taken from the inbuilt lecture

hall Sennheiser audio equipment using a headworn microphone. It is an Adobe Connect built in feature that a pod showing the video and providing the audio can be included.

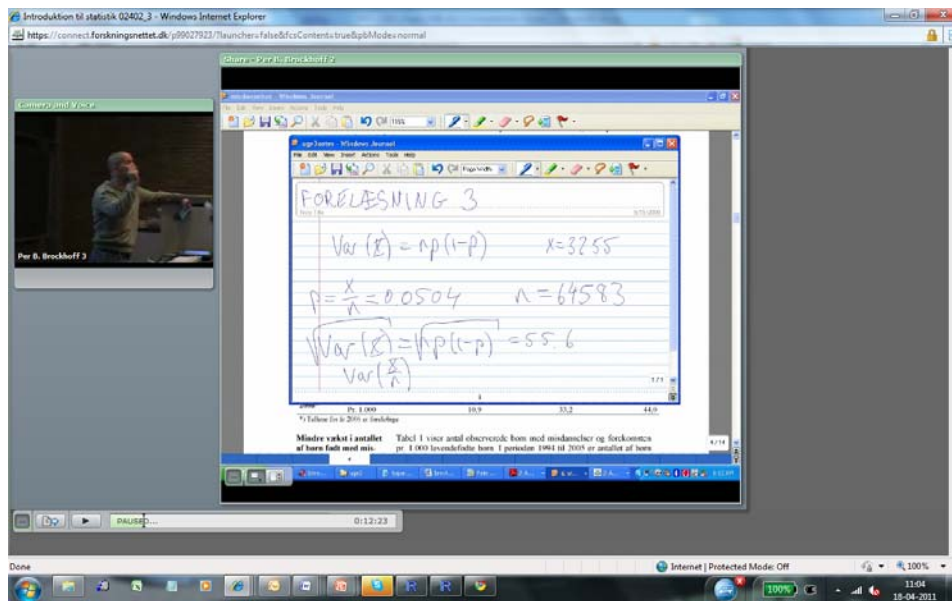


Figure 1

Example of the form of a recorded lecture (02402 lecture 3, 16/9 2008). This is how a recorded lecture appears when subsequently viewed through a web browser. (In this case on a windows based laptop using Windows Internet Explorer).

A key point in making this a workable approach is the fact that a tablet computer is used. In Adobe Connect the computer desktop can be shared in the main pod window, see Figure 1 and 2. This means that all the lecturing teaching instruments can be incorporated into the tablet computer and shared with everyone, including the following instruments used in the 02402 course before the Fall 2008 version:

1. Computer presentations (pdf and/or Powerpoint)
2. Example material on overhead slides – including potential hand writing on slides
3. Internet information using browser
4. Statistical software examples and tutorials
5. Key text book (statistical) tables and figures copied on overhead slides
6. Blackboard based review of key technical issues and example material

Point 1, 3 and 4 are straightforward. Point 5 is handled by scanning-and-viewing instead of using the overhead projector slides. And 2 is handled by viewing the example material on the computer screen instead. And since the tablet computer, in this case a Windows operated one, comes with a hand writing/annotation feature, Windows Journal, that allows you to hand write on any kind of file by printing/inserting it into Windows Journal. Even certain features within Adobe's pdf-viewing and Powerpoint presentations allow for direct hand writing/annotation. Point 6 is handled in the same way, see Figure1 for an example of using the "Blackboard on the Computer" by Windows Journal. A benefit of all this is the ability to easily share these hand written supplements by creating subsequent pdf-handouts of everything.

An important issue after the first round in 2008 was to be able to do the recording in a technical easy-to-use ("plug-and-play") way. In later versions the assistant operated camera was substituted by a fixed webcam with an extension cord and various solutions for the audio capture was tried. The interactive simultaneous student participation was initiated during the 3<sup>rd</sup> offering. An overview of the different approaches used is:

- Autumn 2008: (350 participants)  
Real video camera using video recording assistant, simultaneous transmission to other auditorium. Subsequent upload.
- Spring 2010: (184 participants)  
Use of webcam, subsequent upload – sometimes ONLY the audio. In addition English lectures made with webcam without audience.
- Autumn 2010: (310 participants)  
Use of webcam, subsequent upload. Half of the period: Also simultaneous participation in meeting facility (simultaneous watching via internet possible)
- Spring 2010: (174 participants)  
Use of webcam, subsequent upload AND simultaneous participation in meeting facility (simultaneous watching via internet possible).

The conclusion so far is that a fixed webcam can do a sufficient job, since the video of the lecturer plays no major role in the final lecture videos. The webcam can be positioned such that it captures a few meters of the key “lecturing scene” meaning that the lecturer will be in the picture most of the time, but should he/she step out of the picture every now and then, it is not critical for the end result. Of utmost importance is the audio quality and combined with the wish to be cordless it puts some challenge to the technical equipment, if the best audio result is sought. During the numerous recordings carried out in these four course offerings (and other courses) a number of different simple and cheap audio solutions were tried. A Bluetooth based solution seemed nice, but turned out to be too unstable. If you (in some situations) can cope with not being cordless, a simple corded headset seems to provide a feasible solution. More generally, to obtain easy “plug-and-play” high quality cordless audio, the conclusion is that a portable version of some professional audio system, e.g. Sennheiser or Mipro, combined with a headworn microphone and bodypack is expected to provide the best and most stable result. And still this equipment is small enough to be easily carried around.

### ***Inviting students to actively participate in the meeting room during lecturing***

As listed and mentioned above, the latest feature initiated is to invite students to actively participate in the meeting room during the lecturing – whether they are located in the lecture hall or not. This was initiated during the 3<sup>rd</sup> offering in the Fall 2010, and from the beginning of the Spring 2011 offering. Since chat pods and poll pods are readily available in Adobe Connect, it was straightforward to setup the meeting room to include those facilities. In Figure 2 an example of how it could appear is shown. One chat pod and three poll pods are used here. So far, the chat pod is aimed at having the students asking “follow-up” questions, that is, pointing at things they would like to have clarified by the lecturer in a sub-sequent lecture/video clip. One of the poll pods are used for voting for such potential requests. In the example given here, two more polls are given: One just for fun: asking about the general mood of students today. The other is used for collecting data used as example data in the actual statistics lecturing. In this case the weight of each individual is asked for. Then during the break of the lecture, these data is transformed to the statistical software of the course and subsequently used in the last part of the lecture.

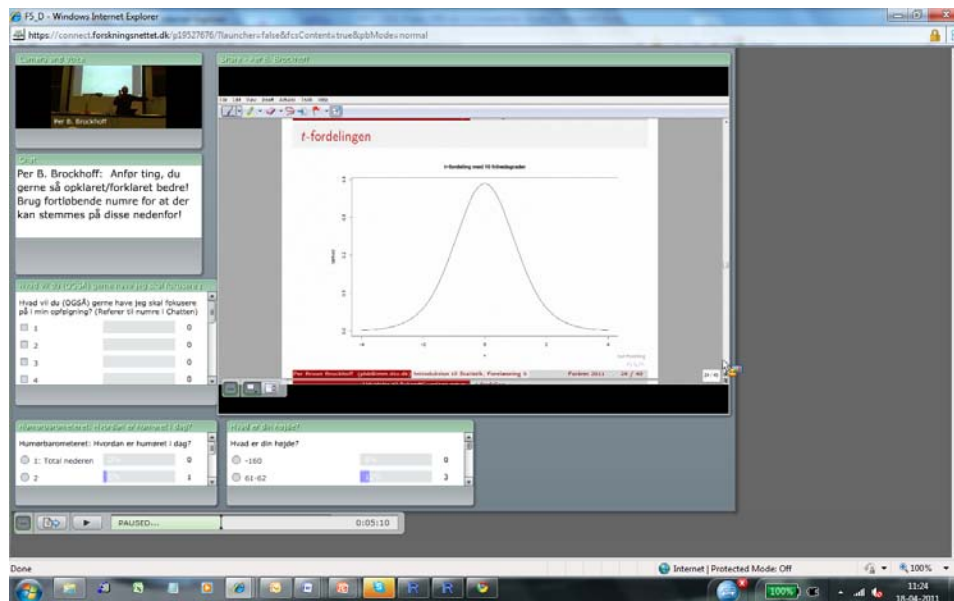


Figure 2

Example of the form of a recorded lecture using chat (one pod) and poll pods (three) (02402 lecture 5, 1/3 2011).

Students participated through their own laptops or by iPhone. At the time of doing this the only smart phone option with the available version 7 Adobe Connect was provided by an iPhone App that only supported parts of the meeting room activity, e.g. the poll feature were not supported. This is something that is changing these months: with the Adobe Connect version 8 and updated Apps for as well iPhone as Android phones increased options for smart phone based participation will develop. In the first try during the 3<sup>rd</sup> course offering only very few students decided to participate. A practical challenge was that since the primary access approach would be by laptop, the lecture hall should be able to provide power plugs for the individual student to expect them to power on their laptops. This was not available in the 3<sup>rd</sup> course offering. In the 4<sup>th</sup> offering (Spring 2011) this was available and the concept was introduced to the students from the beginning of the course. The current activity level amounts to having around 20-30 students as active participants in the meeting during the lectures - most of these sitting in the lecture hall using their own laptops, but also some from other locations. Among the 174 registered students, roughly 50% is appearing in person at the individual lecture. In [1] a short demonstration of how the teaching in this way is carried out in practice.

## OUTPUT

As a side effect of this way of teaching, complete collections of video lectures can be collected and shared without any specific connection with running courses. A note to make here is that it is an inbuilt feature of the Adobe Connect that the recordings can be easily shared simply by sharing an URL – no handling of video files is needed by the user. In writing, close to 200 of such recordings of lectures by the author have been shared with at least the course participants. More recently, public sharing of various videos became more focussed through three open web-sites, cf. [2], [3] and [4], that collects the following:

1. Introductory statistics lectures in English (642 visits during Feb-March 2011)
2. Introductory statistics lectures in Danish (455 visits during Feb-March 2011)
3. More advanced statistical lectures (very recently published)

The English introductory lectures are the only lectures not recorded in a lecture room with audience. The current language situation for the introductory course is that it is (and must be) given in Danish – although using an English textbook. But then the course is given in English in parallel for a relatively small number of participants – around 20 in each course offering - and using the recorded video lectures as a (cheap) way of making this happen. During the Spring 2010 offering the English lectures were created and used during the course in the following way: The non-Danish speaking students were promised that the recorded lectures would be available no later than at the starting time of the Danish lecture each week. And then they were invited to participate in the same post-lecture exercise activity as the Danish students. The lectures were then recorded at the office of the lecturer.

There has been a development of the length of the individual recordings over the four course offerings: In the first one the entire 2x45 minutes lecture and the break(s) were recorded in a single video. In the English versions they are more focussed and with no breaks but still only a single video for each of the 13 (double) lectures. During the 2<sup>nd</sup> and 3<sup>rd</sup> offerings the Danish lectures were recorded as two sub-videos – one before and one after the (main) break. The disadvantage of these relatively long videos is that since the entire desktop is shared in the meeting room (as opposed to just a single specific pdf or Powerpoint presentation), the recording includes no option for the viewer to easily jump from subject-to-subject within the video. This is why in the 4<sup>th</sup> offering during spring 2011, the recordings were carefully planned to be “stopped-and-restarted” following the subheadings of each individual lecture. A double lecture of 90 minutes would then be recorded as 4-7 video clips providing a subject based video-clip collection of the entire course – all together around 70 video clips of around 18 minutes length on average, cf. [3].

In Table 1 the statistics on how many times these videos have been viewed (or at least started viewed) is given. During 2010 (1 Feb 2010 – 1 Feb 2011) there was almost 10.000 hits on the entire collection with around 9.500 of those on the introductory ones. During Feb-March 2011 the hit number was around 3.000, which means that (in writing) 50 times every day of the week someone starts to watch one of the introductory statistics lectures.

Table 1  
Video hit statistics. Numbers are accumulated number of hits as reported by the Adobe Connect video report feature.

	<b>01.02.10</b>	<b>02.02.11</b>	<b>04.04.11</b>
02402 F08 (10 x 90min)	3111	3915	3915
02402 S10 (20 x 45min)	0	3497	3634
02402 F10 (23x45 min)	0	778	811
02402 S10 Eng (15x75min)	0	4409	5124
02402 S11 (70x18 min)	0	46	2117
02429 F10 (25x30 min)	0	230	230
27411 S11 (13x40 min)	0	0	80
Miscellaneous (7x45min)	0	223	268
	<b>3111</b>	<b>13098</b>	<b>16179</b>

## COURSE EVALUATION

The courses were evaluated by the students as any other course at DTU, that is, using standardized questionnaires with no specific questioning related to the new teaching approach. In writing, the 4<sup>th</sup> course offering during the spring of 2011 is not yet finished, so no evaluation information is accessible. Also, as the more interactive use of the meeting

room really only had an impact during this latest offering of the course so the evaluations reported here would include no information about this part. One of the questionnaires asks for qualitative comments from the students using the questions:

What went well – and why? (Question 1.1)

What did not go so well – and why? (Question 1.2)

In Table 2, some statistics are given on these two questions. Among the 20 negative comments in all three courses (847 students) only two comments in the first version of the course specifically was about the writing on the tablet as an alternative to the blackboard. And there was 5 students specifically mentioning this as a positive thing.

Table 2  
Student evaluation of courses

Course	No. of participants	No. of respondents	No. of 1.1 comments	No. of <b>Video positives</b>	No. of 1.2 comments	No. of <b>Video negatives</b>
Fall 2008	350	184	87	38	60	14
Spring 2010	187	61	22	10	15	5
Fall 2010	310	136	40	11	23	1

The one negative comment in the Fall 2010 (and one of the 5 in the Spring 2010) was by one of the English speaking students who ONLY get lectures online. And the comments were exactly about the fact that they did not have access to real life contact with the teacher during the lectures. In each version of these two courses 15-20 other non-Danish speaking students did NOT comment on this. In the first version four of the negative comments were general criticism that the university was not able to provide a room large enough for everyone (which by the way is not a quite fair criticism, since with the turn up percentage common for this course the room WAS big enough for everyone). And the remaining negative comments were all about the times when the technical details were giving trouble. All in all not many comments even about that – and in the latest version of the course NONE what so ever about this. The decrease of the number of positive comments could in a way also be given a positive interpretation: If everything around the recordings and the use of the tablet computer for teaching is just working smoothly it shouldn't be too much in focus, and hence there is no reason for giving any particular comments on that.

## DISCUSSION AND FUTURE PERSPECTIVES

The possibility of inviting people in to listen to (live) lectures even though they are at a different location has some obvious benefits. The same goes for the possibility of subsequent sharing of the recorded lectures. This will provide access to the lectures for individuals that otherwise would not have had this access, be it regular students that was hindered due to illness, travelling, elite sports activity or whatever reason, external research partners from industry and/or other research institutions or students from other courses – the list would be endless. A collection of statistical video lectures could be an important part of the ability to offer individual adapted courses, especially important for PhD education within those many non-statistical fields where statistics plays an important role in research. The same goes for the development of continuing education course activity. Similarly, the collection of videos may serve as part of the ongoing awareness and recruitment challenge for our statistical education and/or our role as important collaborator in research projects.

Apart from this, what potential impact, positive or negative, these extended possibilities have on the behaviour and learning process of the “regular” student in the introductory statistics course 02402 is not 100% clear. The same goes for the potential impact of the attempts of making the large audience lecture more interactive by the use of the meeting room features such as chats and polls. When more advanced applications for iPhones and Android phones are ready, and participants can join this way enjoying (close to) full use of all the meeting room features instead of having to use a labtop (and avoid any external and additional physical poll systems), there is an even larger potential for creating interactivity around the lecture participation. It will be a pedagogical challenge, but if used properly it is the clear conviction of the present author that it can enhance the value of the otherwise maybe somewhat old-fashioned large audience lecture.

So far the student behaviour in these courses has not been monitored in any way (apart from being able to count the number of students in the lecture room together with the corresponding number in the exercise rooms). An idea for the future would be to setup an investigation to clarify this, that is, by a questionnaire or in some other way trying to identify exactly how the individual student behaviour really is. And then link this information on the individual level to course evaluation data and to the final course grade result. This could provide some important information on the real impact of this novel teaching approach.

## REFERENCES

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- [4] Brockhoff, P.B. (2011). Website for “next level” statistics lectures in English: <http://www.imm.dtu.dk/~pbb/advancedonlinelectures.html>

## ***Biographical Information***

Per Bruun Brockhoff is Professor in statistics at DTU Informatics at the Technical University of Denmark (since 2004) and Head of the Statistics Section (since 2008). He was the Chairman of DSTS, the Danish Society for Theoretical Statistics (2003-2007), and Chairman of the International Sensometrics Society (2006-2010). Professor Brockhoff co-authored around 60 peer reviewed scientific papers and 2 books and is an elected member of ISI (International Statistical Institute) (since 2005). He has 16 years experience in planning and teaching large audience introductory statistics courses together with other courses.

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